

WHAT IS CLAIMED IS:

- 1 1. A computer-implemented method for processing numerical values in a
2 computer program executable on a computer system, comprising:
3 encapsulating in a large-integer datatype, large-integer data and
4 associated operators, wherein the large-integer data has runtime expandable
5 precision and maximum precision is limited only by system memory availability;
6 and
7 overloading language-provided arithmetic, logical, and type conversion
8 operators with the large-integer operators that operate on large-integer variables
9 in combination with other datatypes, and programmed usage of a variable of the
10 large-integer datatype is equivalent to and interoperable with a variable of a
11 system-defined integral datatype.
- 1 2. The method of claim 1, further comprising converting a character string
2 into large-integer data in response to a constant definition statement.
- 1 3. The method of claim 2, further comprising converting large-integer data to
2 and from a character string for input, output, and serialization.
- 1 4. The method of claim 1, further comprising:
2 converting input data from language-provided input functions to large-
3 integer data; and
4 converting large-integer data to a format compatible with language-
5 provided output functions.
- 1 5. The method of claim 1, further comprising:
2 establishing a plurality of storage nodes for allocation to large-integer
3 data; and
4 for each large-integer variable having a value other than zero, storing a
5 numerical value in at least one storage node allocated to the variable.

- 1 6. The method of claim 5, further comprising allocating a selected number of
2 bits for each storage node in response to a program-specified parameter.
- 1 7. The method of claim 5, further comprising dynamically allocating a
2 number of storage nodes for storage of the numerical value as a function of a size
3 of the numerical value.
- 1 8. The method of claim 7, further comprising storing in each node that is
2 allocated to large-integer variable, a subset of bit values that represent a
3 numerical value.
- 1 9. The method of claim 8, further comprising:
2 maintaining a set of available storage nodes that are not allocated to any
3 large-integer variable;
4 allocating a storage node from the set of available storage nodes to a large-
5 integer variable while performing a large-integer operation that generates a
6 numerical value and stores the numerical value in the variable, if a number of bit
7 values required to represent the numerical value exceeds storage available in
8 storage nodes allocated to the large-integer variable; and
9 returning to the set of available storage nodes a storage node allocated to a
10 large-integer variable while performing a large-integer operation that generates a
11 numerical value for storage in the variable, if a number of bit values required to
12 represent the numerical value is less than storage available in storage nodes
13 allocated to the variable.
- 1 10. The method of claim 9, further comprising overloading language-provided
2 memory allocation and deallocation operators with large-integer operators that
3 allocate and deallocate storage nodes.
- 1 11. The method of claim 1, further comprising, responsive to a large-integer
2 divide operation specifying an input dividend and divisor:

3 identifying a set of most-significant bits of the dividend and a set of least-
4 significant bits of the dividend;
5 recursively performing a large-integer divide operation using the set of
6 most-significant bits as the input dividend, and returning a quotient and a
7 remainder;
8 finding a lower-part dividend as a function of the remainder and the set of
9 least-significant bits;
10 recursively performing a large-integer divide operation using the lower-
11 part dividend; and
12 concurrently solving for the quotient and the remainder.

1 12. The method of claim 11, further comprising identifying an optimal set of
2 most-significant bits of the dividend and a set of least-significant bits of the
3 dividend as a function of a number of bits that represent the dividend and a
4 number of bits that represent the divisor.

1 13. The method of claim 12, further comprising identifying an optimal set of
2 most-significant bits of the dividend and a set of least-significant bits of the
3 dividend as a function one-half a difference between the number of bits that
4 represent the dividend and the number of bits that represent the divisor.

1 14. The method of claim 1, further comprising emulating fixed-bit arithmetic
2 on variables of the large-integer data type.

1 15. The method of claim 1, further comprising transferring data associated
2 with temporary variables of the large-integer datatype by moving pointers to the
3 data.
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1 16. The method of claim 1, further comprising
2 encapsulating in a large-floating-point datatype, large-floating-point data
3 and associated operators, wherein the large-floating-point data has runtime

4 expandable precision and maximum precision is limited only by system memory
5 availability; and
6 overloading language-provided arithmetic, logical, and type conversion
7 operators for floating-point data with the large-floating-point datatype operators
8 that operate on large-floating-point variables in combination with other
9 datatypes, and programmed usage of a variable of the large-floating-point
10 datatype is equivalent to and interoperable with a variable of a system-defined
11 floating-point datatype.

1 17. The method of claim 1, further comprising
2 encapsulating in a large-rational datatype, large-rational data and
3 associated operators, wherein the large-rational data has runtime expandable
4 precision and maximum precision is limited only by system memory availability;
5 and
6 overloading language-provided arithmetic, logical, and type conversion
7 operators for rational data with the large-rational datatype operators that operate
8 on large-rational variables in combination with other datatypes, and
9 programmed usage of a variable of the large-rational datatype is equivalent to
10 and interoperable with a variable of a system-defined rational datatype.

1 18. An apparatus for processing numerical values in a computer program
2 executable on a computer system, comprising:
3 means for encapsulating in a large-integer datatype, large-integer data and
4 associated operators, wherein the large-integer data has runtime expandable
5 precision and maximum precision is limited only by system memory availability;
6 and
7 means for overloading language-provided arithmetic, logical, and type
8 conversion operators for integers with the large-integer datatype operators that
9 operate on large-integer variables in combination with other datatypes, and
10 programmed usage of a variable of the large-integer datatype is equivalent to and
11 interoperable with a variable of a system-defined integral datatype.

1 19. The apparatus of claim 18, further comprising
2 means for encapsulating in a large-floating-point datatype, large-floating-
3 point data and associated operators, wherein the large-floating-point data has
4 runtime expandable precision and maximum precision is limited only by system
5 memory availability; and
6 means for overloading language-provided arithmetic, logical, and type
7 conversion operators for floating-point data with the large-floating-point
8 datatype operators that operate on large-floating-point variables in combination
9 with other datatypes, and programmed usage of a variable of the large-floating-
10 point datatype is equivalent to and interoperable with a variable of a system-
11 defined floating-point datatype.

1 20. The apparatus of claim 18, further comprising
2 means for encapsulating in a large-rational datatype, large-rational data
3 and associated operators, wherein the large-rational data has runtime
4 expandable precision and maximum precision is limited only by system memory
5 availability; and
6 means for overloading language-provided arithmetic, logical, and type
7 conversion operators for rational data with the large-rational datatype operators
8 that operate on large-rational variables in combination with other datatypes, and
9 programmed usage of a variable of the large-rational datatype is equivalent to
10 and interoperable with a variable of a system-defined rational datatype.